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An overview of East and Central European networking activities

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1. Introduction

This paper is mainly based on work of the RIPE Connectivity Working Group. It summarises the main issues of international connectivity of Eastern and Central European countries. It is based on reports and information gathered by network representatives of these countries, who have been present at the meetings or contacted on other occasions.
Thanks are due to all those who helped us to gather the information. Some countries however, are not represented in this report, due to lack of information. Please contact the author if you have amendments or suggestions. This report is released regularly on a 4-5 month basis.
This report contains lists of people who are responsible for international networking in each of their countries and a map of the current situation in IP networking in the those countries. The map doesn't show all existing international lines of those countries but it seeks to be complete for IP lines and other leased lines without usage restrictions for the academic and research communities.
This report has been written by Milan Sterba <Milan.Sterba@vse.cz> and it does not necessarily reflect the opinions of the authors of the national reports nor those of the RIPE community.

2. Present situation

This chapter gives as detailed as possible descriptions of the various network activities in the East and Central European countries. The sections for particular countries is subject to regular amendments or changes.
Considerable progress has been made during the last year in IP connectivity of ECE countries. Czechia and Poland have today, some two thousand connected hosts each and are the most advanced countries in Central and Eastern Europe with respect to IP connectivity.
Croatia, Estonia, Hungary, Slovakia and Slovenia do also have IP connectivity today and have several hundreds of connected hosts each. IP connectivity has also reached Latvia through Estonia and NORDUnet and also Bulgaria, Romania and Russia and is spreading very rapidly in most of these new Internet countries.
In all the connected countries the initial capacity of international lines has rapidly become insufficient and it has been sought to upgrade existing lines and set up reasonable backup solutions. Internetworking is rapidly spreading and good IP connectivity is considered as the first priority by the national academic network organisations.
All the countries considered, except for Albania and some of the new countries that came out of former Yugoslavia, have at the present time some (often more than one) connection to international networks. Some countries have only a dial-up e-mail connectivity, others have low or medium speed leased lines. The present state of international leased lines to ECE countries is represented on the map which goes with this report.
Having solved basic connectivity problems some ECE countries face now other types of problems concerning deployment of the network through the countries, user services, user information and training, network security, organization of networking and production network financing, involvement of non-academic bodies in networking and more generally transition from a starting and supported country to a fully integrated member of the global network community.
RIPE broadly contributes to this rapid evolution by technical advice and by coordination efforts.

2.1 Albania

An electronic mail connection used to exist between the University of Tirana and the Internet. The gateway and relay function resided at CNUCE, Pisa, Italy. This connection seems not to be operational any more.

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- Francesco Gennai <francesco.gennai@cnuce.cnr.it> - CNUCE, Pisa, Italy

2.2 Baltic countries

All three Baltic countries are developing Research and Education Networks, called respectively ESTNET, LATNET and LITERA-NET. A Baltic backbone, called BALTBONE, will link them together (Kaunas, Vilnius, Riga, Tartu, Tallinn) and to the global Internet via NORDUnet. BALTBONE is partly operational today. A LISTSERV mailing list exists for this purpose <NORDBALT@searn.sunet.se>.

2.2.1 Estonia

Estonia works in close co-operation with NORDUnet in setting up external IP links. Currently 64 kbits/s IP satellite links are operational between Tallinn and Stockholm, and between Tartu and Stockholm. These lines connect the Baltic backbone network (BaltNet) to the rest of the Internet. Another 64 kbit/s IP line is operational between Tallinn and Helsinki.
Inside Estonia IP links exist between the Institute of Cybernetics and the University of Technology in Tallinn and the Tartu University. UUCP and FIDOnet infrastructure is also developed.

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2.2.2 Latvia

An international 14.4 kbit/s IP line connects the Institute of Informatics and Computer Science of the Latvian University in Riga to the Institute of Cybernetics in Tallinn, Estonia. This line is part of the Baltic backbone network (BaltNet). Other networks active in Latvia have only dial-up connections (FidoNet to Tallinn and Helsinki, EUnet/RELCOM to Moscow and other EUnet/RELCOM nodes). FidoNet in Latvia is partly supported by Technical University of Riga and used as an interim academic network.
Inside Latvia X.25 services are available from the public X.25 network Latpak and Sprint, UUCP services are available from JET, Versia and Robosoft, the latvian partners of EUnet/RELCOM. FidoNet also is very active.
Latvia participates in the BALTBONE project. Cooperation also exists between University of Latvia, which hosts the Coordination committee for networking in Latvia, the Institute of Electronics and Computer Techniques and the Technical University of Riga on one hand and DFN and the University of Muenster (Germany). A 64 kbit/s leased line is planned to interconnect Riga and the WIN office in Berlin by May 1993. This line will support X.25 and IP over X.25.

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- Alexander Kirpa <ank@robosoft.riga.lv> - Robosoft Ltd.
- Sergei Rotanov <rotanov@lumii.lat.su> - Institute of Electronics
- Dmitry Sazonov <dima@jet.riga.lv> - JET (RELCOM Riga)
- Janis Sudnieks <john@versia.riga.lv> - Versia Ltd.

2.2.3 Lithuania

A dial-up EUnet connection exists between Vilnius and Helsinki (Finland). Electronic mail UUCP services are offered by several providers in cooperation with EUnet/RELCOM nodes in Moscow, Minsk
A 64 kbit/s X.25 link, used for X.400 electronic mail, X.500 directory services and remote terminal (PAD) access, sponsored by Norwegian Telecom, exists between Vilnius and Oslo (Norway). The usage of this infrastructure however seems to be much lower than the usage of dial-up connections for EUnet and FIDOnet.
In 1991 the project of a LIThuanian Electronic Research Academic NETwork (LITERA-NET) has been created at the Institute of Mathematics and Informatics. LITERA-NET is now acting as top level domain administrator for. lt and has started activities towards spreading IP connectivity over Lithuania. An agreement has been reached between the Polish academic network NASK and LITERA-NET about establishing lithuanian IP connectivity over NASK, which will provide funding for the Polish part of the link. Funding probably remains the main bottleneck for progressing IP connectivity in Lithuania.
Negotiations are going on founding a new Institute of Information Technologies, which would be in charge of the future development of LITERA-NET.

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2.3 Bulgaria

A switched international X.25 connection connects the Bulgarian EARN node in Sofia to Vienna (Austria). An IP connection over public X.25 connects the Bulgarian EUnet backbone node in Varna to the Internet via the EUnet center in Amsterdam. Coordination between both projects is still under study.
Several tens of EUnet sites are now connected over dial-up links and public X25 network to the national EUnet backbone. Some sites are using EUnet IP services. EARN services have been opened at Sofia University and are today spread over about 10 academic institutions. No gateway exists between the two services yet.
The national academic network is organized in a non-profit association UNICOM-B which in fact represents EARN in Bulgaria. EUnet services are provided by a commercial company, which by serving also some academic institutions which have chosen EUnet, is in competition with UNICOM-B.

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- Miroslav Iliev <???????????????> - Bulgarian Academy of Sciences

- Daniel Kalchev <daniel@danbo.bg> - EUnet backbone manager BG, contact for BG top level domain
- Alexander Simeonov <sasho@bgearn.bitnet> - Center for Informatics, Sofia
- Anton Velichkov <vam@bgearn.bitnet> - UNICOM-B and EARN president for Bulgaria
- Rositza Rangelova <rora@bgearn.bitnet> - UNICOM-B secretary

2.4 Commonwealth of Independent States.

2.4.1 Russia

2.4.1.1 Overview of international links

Two 19.2 kbit/s IP links between Moscow and Tallinn and Moscow and St.Petersbourg connect the EUnet/RELCOM network in Russia and a few other xSU republics to the Finnish EUnet backbone in Helsinki and further to EUnet and the Internet. Currently the services consist of electronic mail and network news. These links carry most of the international e-mail traffic from and to xSU.

Another network service provider Demos/+ operates a dial-up IP link between Moscow and AlterNet (USA). An upgrade of this link to 64 kbit/s has been ordered. Demos/+ also operates a more or less unused 64 kbit/s X25 link to DATEX-P (German PSDN). A 9.6 kbit/s leased line between Moscow and DESY, Hamburg (Germany), supporting IP, delivers HEPnet/IP services to two research institutes in Moscow. An upgrade of this link to 64 or 256 kbit/s, rehomed to Moscow State University and funded by DFN is planned for the near future. The link should then be open to a broader academic and research community.

The European Space Agency is funding a 64 kbit/s link between Space Research Institute in Moscow (IKI) and ESOC in Darmstadt (Germany). Another ESA link exists between CNES (France) and IKI.

A dial-up IP link also links FreeNet a smaller IP network between several research institutes in the Moscow area, Jaroslavl and Baku to UNI-C in Denmark.

All existing IP links to CIS have full connectivity to the European part of Internet and to commercial US networks. NSFnet and other governmental US agencies however still do not accept Russian IP networks on their backbones. NASA has asked the US Department of Commerce for an export licence for NASA Science Internet connectivity to Russia. If this licence is granted, this will represent a precedent which may make help other agencies to connect Russian networks as well.

The first EARN node started its operation in Moscow late in 1991. The international connectivity of SUEARN is now provided via a low speed European Space Agency link to ESOC Germany.

Sprint International has installed a point of presence in Moscow. The link goes from the Sprint POP in Moscow to the Washington area.

2.4.1.2 Organizational aspects

A considerable effort undertaken by the EUnet/RELCOM networking organization has brought e-mail connectivity to several thousands of sites all over the former Soviet Union on a fully user funded basis and unrestricted network use from the very beginning. The growth of the network was several 100% a year. Current number of connected nodes is over 6000. The whole network has some 100 regional centres operating as independent companies in all parts of the former Soviet Union. These companies have formed the joint-stock venture EUnet/RELCOM to take care of the common infrastructure, network development and international connections. All companies are using a common network named

EUnet/RELCOM. EUnet/RELCOM is now introducing a full set of IP services over xSU. Problems arise with the poor telecommunication infrastructure and with COCOM restrictions on IP routers and other equipment.
One of the former main nodes of RELCOM, Demos/+ has separated from RELCOM and acts now as an independent service provider which also operates a link to AlterNet. IP connectivity exists between Demos/+ network, FreeNet, EUnet/RELCOM and the EARN node in Moscow.
In July 1992 an official decision has been taken by the Ministry of Science and Higher Education, the Academy of Sciences and the Russian Scientific Center (Kurchatov Institute) to form the Russian Electronic Academic and Research Network (RELARN) which will use network services from several network providers (e.g. EUnet/RELCOM, Demos/+, FreeNet).
The San Francisco Institute for Global Communications has installed in Moscow the central node of an extended BBS system called GlasNet. This non-profit network organization allows isolated scientists, businessmen, journalists etc. to use electronic mail, bulletin boards and offers them fax and surface mail or even telephone or telegram gateway functions. Electronic mail to/from GlasNet can be gatewayed to most e-mail networks in the world.

2.4.1.3 Plans for the near future

Several very realistic plans exist for the near future to upgrade Russian and global CIS connectivity considerably. Several 64 kbit/s lines should be put to the Moscow area. EUnet/RELCOM is planning to put a line to the central EUnet node in Amsterdam.
NASA has recently announced the plan to put a 256 kbit/s link to extend the NASA Science Internet to the Institute of Space Research (IKI) in Moscow to support a joint mission between NASA and the Russian Space Program. This link should be upgraded to a full T1 later this year. NASA will also sponsor for the next two years local connections ranging from 14.4 kbit/s to 2 Mbit/s according to local implementation possibilities from IKI to other cooperating institutes. Connections to RELCOM/RELARN are also foreseen.
Another link is planned between Moscow, the Russian Academy of Sciences and KTH Stockholm, to connect at 128 kbit/s Russian IP networks to EBONE and further NSFnet under joint funding of ISF and NORDUnet.
GARR plans to put a 64 kbit/s link between Gran Sasso (Italy) and Dubna near Moscow. Similar although much more vague plans yet exist also with the US Department of Energy which intends an expansion of ESnet to the physics institutes in the Moscow area. The NASA line might be used for this purpose.
International Science Foundation seems ready to sponsor SprintLink connections to Russian research and academic institutions through the Sprint POP in Moscow area, open for all academic traffic.

2.4.1.4 Internal Moscow plans

A plan exists to interconnect major networking actors in the Moscow area by a fibre optical backbone in the framework of the RELARN project. This backbone should cover EUnet/RELCOM, Demos/+, the Russian Academy of Sciences and others. IKI will probably also be connected to this backbone as well as Sprint POP and Moscow State University (from RAS).
Moscow State University also plans to build a microwave 2 Mbit/s network connecting MSU, Lebedev Physical Institute and the Institute of Theoretical and Experimental Physics (ITEP).

2.4.1.5 Implications

We can foresee that in the near future the aggregate capacity of all international IP links ending in the Moscow area will be about 2-4 Mbit/s with the total number of links being about 15-20. Most of these links clearly concern the same scientific and network providers community. This situation calls for careful coordination between the bodies which fund these lines as well as between their Russian partners to prevent serious problems in IP address allocation and routing, which would affect the whole Internet.
A short overview of all these initiatives also clearly shows, that the Moscow area and through it the whole Russian part of Internet could be connected to the Internet in a more coordinated and more efficient way.

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2.4.2 Belarus

The Belarussian academic network BASNET is an X.25 based network which interconnects academic institutes in Minsk and Gomel and several governmental organizations. It is operated by the Computer Center of the Academy of Sciences of Belarus. International connections are based on IASNET in Moscow.

Contact person:

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2.4.3 Ukraine

Most of the Ukrainian sites have e-mail connectivity through the EUnet/RELCOM infrastructure. However strong tendencies now exist to obtain their own international IP connectivity. Negotiations are underway with the Polish academic network NASK, which has offered to connect the Ukrainian Academic Network UANET, as well as with other national networks and funding agencies.
Many of the organizations involved in networking in Kiev as well as in other parts of Ukraine have recently agreed to join their efforts to build a common IP infrastructure and seek together for international connectivity.
Also the recent activities of NASA and the ISF in Russia will probably be extended to reach other xSU countries.

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2.5 Croatia

The Croatian academic network CARNet has a 14.4 kbit/s link from Zagreb to Ljubljana (Slovenia) which is fully used for IP connectivity. There exists also a leased connection at 14.4 kbit/s from Zagreb to Graz (Austria - ACONET).
The capillarity in the country is provided by leased lines at 64 kbit/s connecting Zagreb, Rijeka, Osijek and Split. The whole infrastructure is based on IP technology, which is considered as priority, although other protocols may be added in the future. In several months this network has grown from zero to some 500 connected hosts today.
In Croatia the coordinating organization is CARNet. CARNet has shown itself extremely efficient in setting up a national IP network and connecting it to Internet in a very short period and almost without any international support. The University Computing Center in Zagreb has been appointed as the operator of the infrastructure including international lines and has been assigned the task to further design and develop the network. A close cooperation exists between ARNES in Slovenia and CARNet.

Contact persons:

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2.6 Czech Republic

A 64 kbit/s IP link between Prague and Linz (Austria) is operational today. The line is full IP carrying general IP, EARN and Czech EUnet traffic. A EuropaNet 9.6 kbit/s link has started operation in March 1993 (Prague-Amsterdam) as part of the one year East Europe IXI pilot. Due to low capacity of the link (64 kbit/s was foreseen by the project) the line is used only experimentally and is not available to CESNET users yet. The Czech Educational and Scientific Network (CESNET) has also a 19.2 kbit/s link to the Slovak Academic Network (SANET) connecting Prague to Banska Bystrica. Another low speed link connects Liberec to DFN as part of a regional network between Czech republic, Germany and Poland.
In February 1993 CESNET has deployed its national infrastructure based on medium and low speed lines to 10 major academic cities (among them Prague, Brno, Plzen, Ostrava) where metropolitan and regional networks are being further deployed. In Prague some 10 major academic institutes are connected to the Prague metropolitan network by 64 kbit/s lines and others should follow. A rapid increase in number of connected nodes as well as international line congestion is the immediate consequence forcing CESNET to seek for increased international bandwidth. By now the network is fully based on TCP/IP.
E-mail services for non-academic users are provided by the Czech part of EUnet (some 20 nodes). Connection of first non-academic users to Internet is under negotiation.
CESNET doesn't have any formal existence yet and is based on a cooperative effort of several universities, the Academy of Sciences, EARN and EUnet and is financed principally by the Ministry of Education. The international lines and the national backbone are operated by Czech Technical University. A good cooperation exists between CESNET and SANET as well as with ACOnet, EARN, EUnet, DFN, INRIA France and others.

Contact persons:

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- Milan Sterba <Milan.Sterba@vse.cz> - Prague School of Economics author of this report, RIPE
- Pavel Vachek <tkpv@earn.cvut.cz> - CTU, CESNET

Comment: during a transition period either .CS or .CZ may be valid for electronic addresses in Czech republic.

2.6 Hungary

Hungary is connected to the Internet, EARN and EUnet by two 64 kbit/s lines from Budapest to Vienna (Austria). The High Energy Physics community has access to HEPnet services via a 9.6 kbit/s leased line between Budapest and CERN, Geneva (Switzerland). All the lines are now running IP.
There are two 64 kbit/s EuropaNet lines planned to come to Hungary, one of them to Bern is already operational, which is another possibility for international connectivity.
Hungary has a good operational public X.25 network which is the base of Wide Area Networking between small and medium sized sites. A high speed (64 kbit/s) national IP backbone (called HBONE) is coming into production in 1993 to provide a country wide IP connectivity and access to EBONE services. In Budapest the core of HBONE will consist of some FDDI networks with 2 Mbit/s lines interconnecting them. Part of this core network is already operational, and most of the HBONE lines are planned to get operational by the end of the year.
In Hungary a national program under the title "R&D Information Infrastructure Program (IIF)" is responsible for the research networking. The "HUNGARNET" coordinates the networking activities of different user groups, meanwhile part of the funding goes through IIF.

Contact persons:

- Peter Bakonyi <h25bak@ella.hu> - President of IIF Exec Com.
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- Laszlo Zombory <h340zom@ella.hu> - Chairman of HUNGARNET
- Nandor Horvath <horvath@sztaki.hu> - Local Internet administrator, domain contact for HU, EUnet backbone manager
- Balazs Martos <martos@sztaki.hu> - HBONE project manager
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2.7 Poland

The main external connections consist of a 64 kbit/s satellite link between Warsaw and Stockholm (Sweden) and a 64 kbit/s terrestrial link from Warsaw to Vienna (Austria). The link to Stockholm is multiplexed with the major part of the bandwidth allocated to IP. The Warsaw to Vienna line is not multiplexed, the full bandwidth is used for IP traffic. Discussions have already been initiated to provide for the upgrade of both links to 128 kbit/s, with the objective of eventually setting up an Ebone Boundary System in Warsaw. A 9.6 kbit/s IP connection is in place between Kracow and CERN, Geneva (Switzerland) for HEPnet services. Another low speed X.25 line is operational between the Technical University of

Wroclaw and DFN WIN Berlin as part of a regional network between Czechia, Germany and Poland.
An agreement has been closed recently between NASK and Ukrainian academic community to put a low speed IP line between Lviv and Warsaw.
Public X.25 services have only started in 1992. Thus connections at national level can only be implemented on switched or leased lines. The country already has an infrastructure of leased lines, multiplexed between EARN/NJE/BSC, IP and other types of traffic operating at speeds between 9.6-64 kbit/s.
The Polish network is coordinated by an organization called NASK (National Academic and Research Network) which also includes the Polish part of EARN. Realistic plans exist to substantially extend IP connectivity over the territory in 1993 using 64 kbit/s lines on their national backbones wherever possible and economically viable. A National Network Operation and Monitoring Center has been set up in early 1992 which operates the whole national and international infrastructure. A system of network user training and support has also been put in place.

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2.8 Romania

International connectivity is provided by a 14.4 kbit/s direct IP line from Bucarest to Vienna (Austria) since March 1993. This line is able to carry both Internet and EARN traffic.
EARN is nowadays the most active network in Romania with several connected nodes in major academic institutions. The technology used for the connections is usually TCP/IP. A dozen of other institutions are connected over dial-up lines to EARN nodes and this number is increasing every day. Increasing demand goes for IP services. Recently EUnet has also started its operations in the country. However Romania has poor internal networking infrastructure. A government project of building a public X.25 network is under commercial negotiations and should start to offer some services in 1993. In Romania the networking activities are coordinated and financed by the National Commission for Informatics. DEC acts as a sponsor for some of these activities as there is a strong DEC clones tradition in the country.

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2.9 Serbia and Montenegro

Serbia has had a 9.6 kbit/s leased line between Beograd and Linz to carry EARN traffic. Currently this line is cut according to a decision of the Austrian government about the UN embargo of new Yugoslavia.

Contact persons:

❍ Jagos Puric <xpmfd01@yubgss21.bitnet> - EARN director for YU

2.10 Slovakia

A 19.2 kbit/s X.25 link between Bratislava and Vienna connects the Slovak Academic Network (SANET) to the Internet. It is shared between EUnet traffic, general IP traffic and IXI. The upgrade of this link to 64 kbit/s is planned for the near future. Another 19.2 kbit/s international IP link connects SANET in Banska Bystrica to CESNET in Prague and further to Internet. An upgrade of SANET-CESNET connection to 64 kbit/s is planned. Negotiations are underway on Slovakia joining the East European IXI pilot.
On national scale the SANET infrastructure reaches some 10 major academic cities in Slovakia using mostly 19.2 kbit/s lines, with central nodes in Banska Bystrica and Bratislava. A 64 kbit/s backbone is being build between Bratislava, Banska Bystrica and Kosice.
Academic networking in Slovakia is coordinated by the SANET association. A good cooperation exists between SANET and EUnet as non-academic service provider as well as with CESNET in Czechia and ACOnet in Austria.

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Comment: a migration to the .SK top level domain will take place during 1993.

2.11 Slovenia

Slovenia is connected over a 64 kbit/s IXI access point in Ljubljana to the IXI backbone. Over this connection an IP link via JANET (London, UK) and a backup link via NIKHEF (Amsterdam, NL) provide Internet connectivity. IP services are now available over the whole ARNES networks in Slovenia. Another IXI access point, also located in Ljubljana, connects organizations which have access only to PPSDN. In this way also Croatia and Bosnia and Herzegovina have international connections. A dial up connection connects the main EUnet node in Ljubljana to EUnet.
In Slovenia the Academic and Research Network of Slovenia (ARNES) is coordinating network activities. Currently Slovenia has achieved a good degree of capillarity of its national network due to the existence of the ARNES backbone which links the major sites with 64 Kbit/s and 2 Mbit/s leased lines and due to a wide spread public X.25 network. The ARNES backbone supports IP, DECNET and X.25 protocols. There exists also a well developed X.400 service. in Slovenia.

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2.12 The Former Yugoslav Republic of Macedonia

The University of Skopje has been appointed by the Ministry for Science and Technology to start the networking activities in the country. They joined the CEEC mailing list and they are planning soon an IP connection.
Currently Macedonia has achieved a good degree of capillarity of their national network (DECNET) due to the existence of the public X.25 network which is a part of JUPAK PPSDN.

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3. Evolution

All the ECE countries are very interested in European as well as world wide IP connectivity. In Croatia, Czechia, Estonia, Hungary, Poland, Slovakia and Slovenia there has been rapid growth of connected IP networks and hosts mostly in the academic community. Vienna University, Linz University, Graz Univ. of Technology and ACONET in general (Austria) has become an important point of access to the Internet for Bulgaria, Croatia, Czechia, Hungary, Poland, Romania, Slovakia and Slovenia. In most of the countries existing international leased lines infrastructure is now shared by EARN, EUnet and raw IP services.
The financial resources dedicated to networking in these countries are limited. The sharing of the existing national and international leased lines between EARN, EUnet and other IP traffic as well as between academic and starting commercial traffic is thus a very important issue. Lightweight but robust IP gateway solutions (over dial-up lines, leased serial lines or X.25 networks) are of great concern in this respect and are continuously studied and further developed (e.g. COPERNICUS).
In the same time the national infrastructure of the countries will also evolve. We can expect an increase in national coverage in countries with working public X.25 networks (Hungary) and in Croatia, Czechia, Estonia, Slovakia, Slovenia and Poland as well as strong increase in IP connectivity in some parts of the CIS (Moscow area, St. Petersbourg, Ukraine...)

4. International Initiatives

Several international support initiatives have been launched in the past by different bodies to improve international network connectivity of the Central and Eastern European countries. The following list presents some of them:
The Ebone 92 consortium has shown itself very supportive during 1992 by allowing traffic of ECE countries to pass freely over the Ebone and letting so the ECE countries traffic cross Europe. EBONE continues to be very supportive to ECE countries in 1993, although its financial model has changed considerably. An establishment of an EBS in Vienna is

now under careful consideration at the joint demand of Austria and ECE countries issued from the ECE networking initiative.

RIPE and the RIPE NCC have widely contributed to the rapid integration of new ECE networks into the global Internet. RIPE has acted as an initiator of a common coordination effort of academic networking organizations in Bulgaria, Czechoslovakia, Hungary and Poland. A first coordination meeting has been held in Prague in february 1992 and a successful cooperation has started since, continued on 3rd Joint European Networking Conference in Innsbruck, where RARE has proposed to be the coordinating place on ECE integration to european academic networking and another meeting in Prague in August. CEEC@RARE.NL is now the focusing mailing list on common ECE networking issues.
Another coordination meeting has been held in Vienna in December 1993, where ECE countries agreed on an even closer and more formal cooperation and agreed to proceed together to seek for better IP connectivity and to support the creation of an Ebone Boundary System in Austria.
Also both EARN and EUnet have widely contributed to the successful start of international networking in ECE countries, by placing the first network nodes to these countries, supporting the activity of these nodes both financially and by extensive know-how transfer.
Despite this expressed cooperation willingness (RARE, RIPE, EARN, EUnet etc.) we still can see little coordination between support efforts and local networking initiatives. An EC PHARE project dedicated to extend the former COSINE IXI project to Bulgaria, Czechoslovakia, Hungary, Poland and Romania has started in 1992. Slovakia's joining this project is under consideration. Medium speed 64 kbit/s lines have been ordered between Amsterdam-Prague-Budapest-Bern. The Budapest-Bern line became operational as first in April 1993. An experimental 9.6 link is currently operational between Prague and Amsterdam. These lines initially financed by the EC till the end of 1993 should provide connectivity from ECE countries to X.25 services of EuropaNet.
The EC has also contracted with DFN-Verein e.V. the German Academic Network Association, to conduct a survey of telematic infrastructure with the academic communities in each of the 6 countries. The report has been submitted to the EC and other supporting projects may follow.

Austria is the major relay point between ECE countries and Western Europe (and further). The Austrian government is very supportive and either covers fully or participates in a significant manner to costs of international connections to these countries and provides them with connectivity to Ebone 93. The Vienna-CERN line has been upgraded in october 1992 to 256 kbit/s and the Linz-CERN line (64 kbit/s) has been replaced by a Linz-Amsterdam line (128 kbit/s) in order to accommodate traffic increase from these countries and offer a real backed-up connectivity to Ebone. The ACONET proposal for Ebone 93 to place an EBS to Austria seems well justified from the point of view of ECE countries connectivity.
CERN plays also an important role in the IP connectivity of the new countries. It houses actually a 9.6 kbit/s line from Krakow and another HEPnet 9.6 kbit/s line from Budapest. Due to lack of resources CERN prefers not to house a lot of low rate lines from every country but rather to house a higher rate line concentrating traffic from several countries. This is in fact in perfect conformance with the ACONET proposal.
The German DFN network has launched several regional initiatives to connect sites in geographical proximity of Germany (e.g. Dreilaendereck project connecting Liberec in Czechoslovakia, Wroclaw in Poland and Zittau in Germany using leased links based on X.25 with further connectivity to DFN). DFN also provides X.400/SMTP gateway for Slovenia. DFN is also planning to sponsor a 64 kbit/s line from Hamburg to Moscow as well as a

64 kbit/s line to Riga.
The Italian government has financed in 1990 and 1992 successful network workshops (NetSchool) to which about 50 network specialists from ECE countries have attended. A second extended edition of NetSchool has taken place in April 1992 with participation of network specialists from RIPE and attendees from ECE countries, some South American, Asian and African countries. Similar events are organized regularly by NORDUnet for network users and operators from the Baltic states.

Since 1991 ACOnet in Austria is offering a "Network Seminar and Intensive Course" for scientists and network managers from Central Europe. This activity is supported by the Austrian Ministry of Science and Research, Digital Equipment Corporation and other contributions. Technical presentations are given by specialists from various Austrian university sites as well as by key people from European and national networking organisations. Enrolment per event is about 50 to 60 people. The fourth network seminar, scheduled for the last week in February'93, is accepting another 65 participants, adding up to a total of about 220 people invited from all over central and eastern Europe.
The French government has expressed its willingness to help the integration of new countries to the world of academic networking by launching in cooperation with INRIA a project called Copernicus, which aimed at improving network connectivity of several Eastern European Countries. One of the first results of this project has been the cooperation on design and implementation of the academic IP backbone CESNET-SANET (Prague - Brno - Bratislava, Banska Bystrica - Kosice) in Czechoslovakia. The project consists of network management and administration know-how transfer, common development of tools and some software and hardware donations. A similar activity has now started with Romania.
IBM is also present in these countries with its academic initiative in which IBM mainframes have been offered to Czechoslovakia, Hungary and Poland. IBM and EASInet act also as sponsors for the T1 US link usage for academic networks in Croatia, Czech republic, Hungary, Poland, Romania, Slovakia and Slovenia.
DEC is also strongly supporting the start and spreading of academic networking in Czech republic and Slovakia by offering considerable discounts and adopting a very cooperative attitude towards academic initiatives. DEC with ACOnet also sponsored two successful networking seminars in Vienna as well as seminars in several ECE countries (Commenius Workshop in Czech and Slovak republics). A similar approach leads now DEC to help to the rapid development of academic network in Romania.

Strong support to ECE countries integration into the global network also comes from the United states. NSF has always been very supportive to academic networks in ECE countries promptly helping them to solve the global connectivity problems. Support also comes from NASA and other federal agencies, various foundations and commercial networks. Many projects aiming at improving local, national and international infrastructure, know-how transfer and mission oriented network applications are now in progress.
The assistance of countries with developed networking shouldn't be uniquely oriented to basic network connectivity. A lot of work is to be done in the ECE countries to offer and improve higher level network services like e-mail, teleconferencing, archive services, online databases and library catalogues etc., as well as in basic network concepts, user information services and advanced networking know-how transfer. That's why new EC projects proposals are now oriented not only on infrastructure but also on higher level services (e-mail, electronic directory, user information and training). Lack of funds is extremely disadvantageous and the exchange rates still make it difficult for ECE network experts to attend international network events.

5. Some technical issues

As already mentioned, distributing international network access over the local territory is a major problem for the countries considered. While it is relatively easy and cheap to set up a local TCP/IP network it is more difficult to connect it to the national access point. Generic router solutions are rather expensive on one side and not completely free of administrative exportation problems for all countries involved.
The solution to these problems are software routers based on PC's or workstations and public domain or easily available software.
A low cost capillarity of networks being of great importance to ECE countries, good dial-up IP solutions both industrial and public domain, which are under study and evaluation in EUnet, RIPE, Copernique, NetSchool and others, are of great interest as well as low cost IP solutions on synchronous lines (X.25 or PPP) and low cost solutions for network monitoring and management.
The technical speed limitations for international leased lines seem now to become less restrictive than in the past. For Czechia, Hungary, Poland and Slovenia terrestrial international links up to 2 Mbit/s are now feasible. In other countries satellite technologies must be used for the time being. National and namely metropolitan telecommunications infrastructure seems to be the main bottleneck in most of them.
With the basic connectivity problems being progressively solved the network services are now becoming major issues in the most advanced ECE countries. PC's remain the most spread technical basis, thus network solutions based on this platform (routers, mail, news, archive and information servers and clients) either Unix or MS DOS oriented are of major concern today.

6. Organizational issues

The starting period in international networking is often characterized by a fuzziness in the organizational structure together with a lack of information about the people actually responsible and working in the area. The situation is nearly stabilized in Croatia, Czech republic, Hungary, Poland, Slovakia and Slovenia, where national academic networking groups have been founded and are coordinated with EARN/EUnet activities, and a coordinated effort tends to build nation wide multiprotocol academic network infrastructures. A similar effort is underway in Bulgaria (UNIKOM, EARN and EUnet Bulgaria). These countries seem also to have found a stabilized position in international network organizations (EARN, EUnet, RARE, RIPE). The situation is more complicated in other countries where also international contacts are for various reasons much more scarce.